# High harmonic spectroscopy of strongly correlated and topological materials

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The recent discovery of high harmonic generation in solids [1], merging the fields of strong field and condensed matter physics, opened the door for the direct observation of Bloch oscillations [1], all-optical reconstruction of the band structure [2] and direct observation of the influence of the Berry curvature in the optical response [3].

In this work, we will focus on high harmonic generation in strongly correlated and topological materials. First, I will show how high harmonic spectroscopy can be used to induce and time resolve insulator-to-metal transitions in strongly correlated materials, using the Hubbard model [4]. I will further demonstrate how high harmonic spectroscopy can be used to identify topological phases of matter and how the Berry curvature leaves its fingerprint in the nonlinear optical response of the material [5]. Using a combination of w-2w counter-rotating strong circular fields, we demonstrate that we are able to induce valley polarization in hexagonal 2D materials and use HHG spectroscopy to read the valley polarization [6]. At last, I will show how the use of Wannier orbitals can be useful in the calculation of the nonlinear optical response of solids [7].

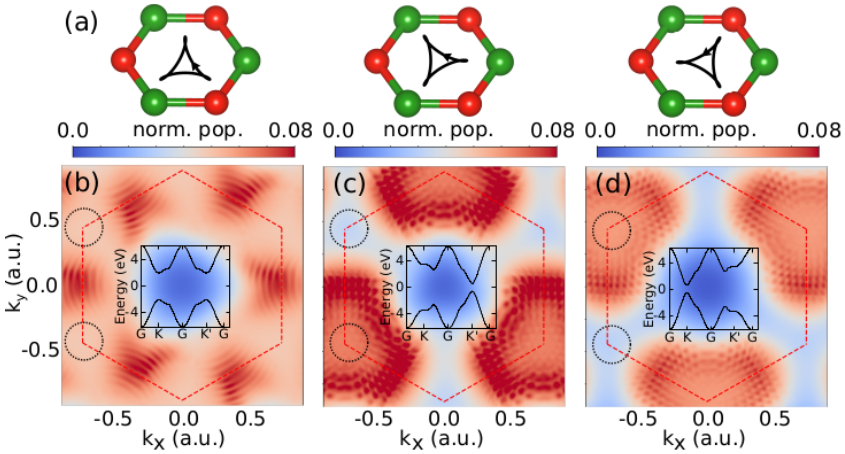


Figure 1: (a) Different orientations of the bicircular field with respect to the lattice, controlled by the phase delay between the two colors. (b-d) Normalized electron population in the lowest conduction band of hBN after applying the bicircular field above with 3 micron of fundamental wavelength.

## References

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